FINANCIAL ANALYSIS

A. Methodology and key assumptions

1. The proposed project supports investments in energy efficiency and renewable energy to reduce carbon emissions by the electricity industry in the Maldives. This will help reduce the cost of electricity, the level of government subsidies, and dependence on imported fossil fuels to meet energy requirements. The project is expected to provide an example for other hybrid grids in similarly placed island locations, or for countries with limited grid coverage.

2. Five representative subprojects were selected in consultation with the government. These are categorized by three different kinds of technical design:

(i) **Type A.** This design is for larger islands with reasonably new and efficient electricity operations. The islands have large and predictably fast-growing populations. The proposed technical configuration includes solar photovoltaic technology and diesel generator sets with no initial requirement for energy storage.
(ii) **Type B.** This design is for midsized islands with electricity grids at variable levels of efficiency. Their populations are expected to grow at an average pace. The proposed technical configuration is for a combination of solar photovoltaic technology, diesel generator sets, and energy storage.
(iii) **Type C.** This design covers the smallest inhabited islands in the Maldives with low levels of electricity efficiency and load growth. To minimize the cost of diesel-based electricity generation, the technical configuration proposes a significant share of renewable energy.

3. Hybrid (e.g., renewable energy and diesel) designs were developed with HOMER optimization software, which uses information such as solar irradiance and wind data, diesel generator specifics, and load curves to yield a desirable configuration that minimizes investment, operation and maintenance (O&M), replacement, and diesel costs over an expected life of 25 years. The financial analysis considered the software outputs in line with Asian Development Bank (ADB) guidelines.[1]

B. Regulatory Framework

4. Electricity tariffs are set by the Maldives Energy Authority (MEA), which is responsible for overseeing sector regulations. The utilities' revenue has several components:

(i) **Tariff (excluding surcharges)**. MEA set the electricity retail tariffs in 2009, differentiated by consumer category (business, business special, domestic, and government) and by geographic region.
(ii) **Fuel surcharge and fuel surcharge subsidy**. Utilities are allowed to recover an increase in fuel costs over the 2009 baseline cost of fuel through a surcharge. The government and "business special" consumers pay the fuel surcharge, while the government subsidizes the fuel surcharge on behalf of domestic and small business consumers.
(iii) **Usage subsidy**. Introduced in 2009 for domestic consumers, the subsidy is paid directly to the utility, FENAKA and STELCO.

[1] ADB, 2005. *Financial Management and Assessment of Projects*. Manila.

5. MEA is considering a tariff methodology to periodically calculate and set tariffs on a cost-plus basis. The implementation of the five subprojects in phase 1 of the project is expected to yield information on investment costs and operating efficiencies that could be utilized for tariff calculations and to finalize the methodology. This will allow periodic resetting of retail tariffs to reflect costs.

C. Weighted Average Cost of Capital

6. Four sources of funding have been established for the project. Apart from ADB ADF grants and ADB administered Strategic Climate Funds grants, the Government of the Maldives will also receive loans from the Islamic Development Bank and the European Investment Bank. The government will relend the loans to the utilities, but bear the impact of foreign exchange risk and interest rate risk. The government has also allocated $14 million, its share of the project cost, as equity contribution in cash and in kind. Based on the above, the weighted average cost of capital (WACC), computed on an after-tax basis in real terms, is 1.2%. The WACC for the five sample subprojects is actually lower since these would be financed only by funds from ADB or funds administered by ADB. However, given the various financing sources available, a WACC of 1.2% is taken to be more representative of the proposed project.

D. Project Costs and Benefits

7. Financial viability was assessed by comparing the incremental costs and benefits under two scenarios: “with project” and “without project”. In the without-project scenario, the electricity utility is expected to continue its operations with 100% dependence on diesel, limited operational efficiency, and sub-optimal sized generator sets, which would result in the need for higher tariffs and government subsidies to cover increases in costs. In the “with project” scenario, the investment in energy-efficient generator sets and distribution grids, along with control systems, will improve operational efficiency and allow for data on key parameters such as fuel intake to be sent by remote control from each outer island to the utility’s headquarters. It will also enable replacement of diesel-based power with clean solar energy.

8. To compare project costs, the analysis factored in incremental capital costs such as contingencies associated with the investments. It compared O&M costs for the proposed type B design (solar photovoltaic technology, energy storage, and diesel generator sets) with O&M costs for a system based 100% on diesel. It also considered periodic replacement of energy storage equipment or diesel generator sets. The cost of diesel is expected to fall as diesel use declines thanks to efficiency factors and replacement with renewable energy. The analysis assumed a yearly degradation factor of 0.8% for solar photovoltaic equipment. It assumed benefits to be realized progressively from the year of completion, and applied an evaluation period of 25 years.

9. To better compare the with-project and without-project scenarios, the retail tariffs and usage subsidies were kept at the same level. The fuel surcharge and fuel surcharge subsidy calculations, which represent the revenue stream to the utility, were recomputed to factor in the impact of reduced diesel consumption thanks to the introduction of renewable energy and greater operating efficiency.

10. Incremental financial benefits and costs were expressed in real prices during the life of the project. Diesel prices were derived from the World Energy Outlook scenario and based on the current policy view of a 1.39% annual increase.

E. Calculation of the Financial Internal Rate of Return

11. Incremental cash flows attributable to the proposed investments were estimated based on the methodology and assumptions described above. The financial viability of the project was assessed by comparing the WACC in real terms with the financial internal rate of return (FIRR). The sensitivity of the FIRR to adverse movements in the underlying assumptions was also assessed. The FIRRs for the subprojects compared favorably with the WACC of 1.1%, as detailed below:

12. **Subproject 1: S. Addu.** The proposed design (Type A) includes investments in grid upgrades, control systems, solar photovoltaic equipment, and inverters. The financial analysis was carried out using a conservative estimate of fuel consumption of 0.29 liters per kilowatt-hour (l/kWh) for the base case, in line with field studies. After the investments, fuel consumption is expected to improve to about 0.26 l/kWh. The share of renewable energy is 7.3% annually. Growth rates are based on expected growth in demand from business consumers until the system has reached its capacity. The project benefits for the utility, FENAKA, include a reduction in diesel costs partly offset by the investment cost, an increase in O&M costs, and a reduction in the revenue stream from fuel surcharge and subsidies. The financial net present value (FNPV) in the base case is $10.2 million, and a FIRR of 11.7% compares favorably with a WACC of 1.2%.

13. **Subprojects 2 and 3: Lh. Kurendhoo and Ga. Vilingili.** For these islands (Type B), the investment includes replacement of diesel generators, installation of control systems, grid upgrades, solar photovoltaic, and energy storage. The extent of solar photovoltaic use and energy storage is determined through HOMER to minimize the net present cost of the system. Growth in demand is considered at 5% per annum until the system reaches its capacity. Fuel consumption before the investment is taken at 0.4 l/kWh for Lh. Kurendhoo and 0.35 l/kWh for Ga. Vilingili. After the investment, fuel consumption is assumed at 0.31 l/kWh for Lh. Kurendhoo and 0.29 l/kWh for Ga. Vilingili. The share of renewable energy reaches 38% on Lh. Kurendhoo and 11.2% on Ga. Vilingili. The FNPV is $1.7 million for Lh. Kurendhoo and $1.2 million for Ga. Vilingili. The respective FIRRs of 9.1% and 5.6% compare favorably with a WACC of 1.2%.

14. **Subprojects 4 and 5: Th. Buruni and B. Goidhoo.** The investment includes replacement of diesel generators, control systems, grid upgrades, solar photovoltaic, and energy storage. Growth in demand is considered at 2% per annum. The Type C methodology was initially studied to maximize the renewable energy share to more than 80% annually, and then to optimize costs. This requires a significantly larger investment in solar photovoltaic technology and energy storage than is the case with Type B islands. The financial analysis used pre-investment estimates of 0.4 l/kWh for B. Goidhoo and 0.5 l/kWh for Th. Buruni. After the investment, both islands reach levels of 0.3 l/kWh. The share of renewable energy is 80% on Th. Buruni and 82% on B. Goidhoo. The FNPV is $0.8 million for Th. Buruni and –$0.5 million for B. Goidhoo. The FIRR for Th. Buruni is 5.2% and compares favorably with the WACC, but is –0.9% for B. Goidhoo.

15. However, if one applies the Type B design to these islands, the FNPV is $1.2 million for Th. Buruni and $0.6 million for B. Goidhoo, with FIRRs of 13.8% (Th. Buruni) and 4.9% (B. Goidhoo), indicating greater financial viability. Both islands would be developed under the Type B design. Given the significant capital investment needed to convert islands for a Type C configuration, it should be considered only for the very smallest islands (and those with a fuel consumption in excess of 0.5 l/kWh) to make the project financially justifiable. An expected

reduction in the nominal costs of solar photovoltaic equipment and, more importantly, energy storage will improve the financial viability of Type C projects.

F. Risk Assessment and Sensitivity Analyses

16. **Risks.** The following are considered key risks for the project based on an assessment of the Public Expenditure and Financial Accountability (PEFA) Report for the Maldives[2], and due diligence of the utilities:

(i) **Budgeting**. PEFA suggested a substantial risk here that could jeopardize the availability of counterpart funds for the project if other government priorities were to arise during project implementation. The need for counterpart funds for the project was determined during investment planning in 2012 and confirmed by the fact-finding mission. Timely availability and disbursement of counterpart funds is be covenanted in the grant agreements.

(ii) **Accounting, financial reporting, and external audits**. The 2009 PEFA score rated this risk as substantial based on limited financial reporting prevalent at that time. In 2009, less than 50% of government entities were subject to financial audits. The environment for financial reporting and auditing has since improved, especially in the electricity industry, after the Office of the Auditor General appointed external auditors to cover STELCO and FENAKA. In line with the project preparatory timelines, FENAKA has finalized the annual accounts for 2012 in April 2014 and is now finalizing the accounts for 2013. The accounts of four of the six FENAKA predecessor companies have been completed and are being audited. An audit report for STELCO for 2012 is available and is largely satisfactory. Audit reports are expected for FENAKA and the predecessor utilities in the third quarter of 2014 with qualifications on fixed assets and inventories related to legacy operations. To overcome deficiencies, FENAKA's board will initiate a one-off valuation exercise and reconciliation of fixed assets, spares, and inventory, and will issue the Request for Proposal for this engagement prior to grant disbursement. The valuation exercise is expected to be completed within 2015.

(iii) **Internal controls and internal audit**. Both STELCO and FENAKA have internal audit committees. Information on procurement of ADB-financed components and counterpart procurement will be disclosed.

17. **Other key risks.** These include higher capital costs and injudicious selection of subprojects. Capital cost calculations are based on recent projects in the Maldives with allowances for installations on remote atolls and cost of maintenance. The selection criteria impose an economic and financial hurdle rate that needs to be exceeded for the subproject to be eligible for selection and implementation. A project management unit, assisted by international and national advisors, will support to address the audit issues and develop capacity through the financial management working group.

19. **Sensitivity analysis.** The sensitivity of the subprojects selected for phase 1 was assessed against changes in key variables—10% increase in project capital costs, no increase in diesel costs, and reduction in solar intensity. The subprojects' FIRRs remained above the WACC in all cases. On this basis, the investment is considered financially viable.

[2] World Bank. 2009. *Public Expenditure and Financial Accountability Report.* Washington DC

Table 1: Sensitivity Analysis

	Base Case	Increase in Project Costs by 10%	No increase in diesel costs	Reduction in solar intensity by 10%
S. Addu	11.7%	10.3%	9.9%	10.7%
B. Goidhoo	4.9%	3.8%	3.5%	4.2%
Th. Buruni	13.8%	12.4%	12.1%	13.1%
Ga. Vilingili	5.6%	4.4%	4.0%	4.8%
Lh. Khurendhoo	9.1%	7.7%	7.4%	8.0%

Sources: ADB staff estimates based on feasibility studies undertaken by the PPTA consultants.